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E-Learning for Medical Education: Improving Quality of Medical Education and Healthcare in Rural Zambia – a Report

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***Abstract*—**

Zambias' severe shortage of qualified medical personnel in rural areas is tackled with an upgrade training for clinical officers to medical licentiate practitioners (MLPs). Chainama College of Health Sciences (CCHS) offers this upgrade training as a 3-year in-service, on the job training in decentralized teaching hospitals. However, as the training is challenged by staff shortages and high workload of medical consultants at practicum sites, we introduced - as part of a collaborative project - a self-directed e-learning platform to supplement teaching and learning. The cooperation is between Zambia (CCHS), Germany (Heidelberg Institute of Public Health) and Switzerland (SolidarMed). The ML e-learning platform offers and has put its focus on: high quality and relevant medical content, a ubiquitous and timely unrestricted access to the contents, as well as low cost and robust technology. The joint approach aims to strengthen medical education in Zambia with a comprehensive evaluation as basis to customize the e-learning implementation to the given setting and ensure its sustainability. A first evaluation showed the introduced system as feasible, but still identified need for improvement especially with regards to specialized medical e-learning contents, training of IT staff, technological adequacy and automatization of processes.

Keywords*—computer-assisted instruction; handheld computers; computer user training; Africa; developing countries; medical education; medical students; blended learning; e-learning*

I. Introduction And Background

The project "Improving the quality of medical education and healthcare in rural Zambia by implementing a sustainable and continuous blended-learning approach of teaching and training for medical education at Chainama College of Health Sciences in Lusaka, Zambia" (short project name: Blended Learning in Zambia, BLiZ) aims to strengthen skills and knowledge of Medical Licentiate Practitioners (MLP) and thereby improving medical care for Zambia's population, especially in rural areas. BLiZ is a collaborative project between Chainama College of Health Sciences (CCHS), the Swiss NGO SolidarMed, and the German Heidelberg Institute of Public Health.

MLs are working as clinical practitioners just below the level of trained Medical Doctors. They are able to diagnose patients, perform a range of essential surgical procedures and manage Level 1 hospitals in the periphery of Zambia, where they are mainly postioned. Accordingly, their training comprises theoretical and practical training in Internal Medicine, Paediatrics, Gynaecology and Obstetrics, and Surgery. An additional focus of the ML training is on emergency care, aiming to stabilize patients in the periphery for referral to higher level care.

The retention rate in public service of ML is high. As of 2013, data from CCHS show that no Medical Licentiate has left Zambia[1]. Therefore, there is strong potential to translate training into better care, since educated ML are retained within the Zambian health system. CCHS is the main governmental training institution for ML aiming to provide quality and competitive education and training in health sciences that cover all levels of health care delivery.

One challenge is that during the two years of decentralized practical training, in which ML students are attached to peripheral level 2 hospitals, they have limited access to books and other academic information. In response, an e-learning platform was developed to provide ample information for self-directed studies in addition to the structured face-to-face and bed-side teaching. Early in 2016, the ML e-learning platform was set up and computer tablets were provided to 4th year ML students in a first pilot phase for decentralized learning. For the academic year 2016/ 2017 this was expanded to all ML students in their practical clinical rotations (3rd and 4th year). The e-learning component is in line with the National Training Operational Plan 2013 – 2016 (NTOP) of Zambia with one of its key recommendations being the strengthening of e-learning in order to meet the vision of providing cost effective qualified health training as close to the need as possible, thus mitigating the critical shortage of health workers. The aim of this report is to provide information of the technical approach and the first preliminary evaluation of this "work in progress".

II. Medical Licentiate E-Learning Platform

An expert group of lecturers and site consultants in cooperation with partners from SolidarMed and Heidelberg University developed the contents based on the curriculum and learning needs of ML students, starting from a base of contents from an e-learning platform initiated at the Kamuzu Central Hospital in Malawi[2]. Through workshops, all site consultants and lecturers are encouraged to contribute to the continuous process of material development and updating on the e-learning platform.

A. Structure of ML E-Learning Platform

The ML e-learning platform runs on the open-source software Moodle and is structured in five sections, mirroring the ML curriculum: Internal Medicine, Obstetrics and Gynaecology, Paediatrics, Surgery, and Virtual Patients. ML students – currently covering third and fourth year students - receive a tablet to carry when on their clinical rotations. After completing their studies, they may acquire the tablet at a subsidized price so they are able to continue accessing the materials when working as ML practitioner. The Moodle app

installed on the Android tablet allows synchronizing static contents offline on the tablet, so students are able to access most of the materials independent of Internet access (see *table 1: Materials available on the ML e-learning platform*).

The training scheme to introduce students to the e-learning platform includes tutorials available on paper and online, as well as face-to-face training sessions when tablets are handed out.

B. Evaluation ML E-Learning Platform

Detailed evaluation is an integral part of the project design. The evaluation covers one full academic year and focuses on competence gain, technology acceptance, sustainability, relevance of e-learning contents for medical education and for daily clinical work, user-friendliness and its usage statistics, covering ML students and ML lecturers. The evaluation aims to create evidence on how the project influences quality of medical education and how the change in quality of medical education influences the daily clinical work of ML. For this, we apply various evaluation methods for the different target groups, like questionnaires, learner diaries, pre- and post-tests, individual interviews and focus groups.

From January 2016 to May 2016, we assessed the first pilot phase on the need for the ML e-learning platform, as well as an evaluation of the feasibility, usability and acceptance of the e-learning platform.

Two questionnaires have been prepared to test for acceptance, ease of use and adoption of the ML e-learning platform by ML students and lecturers. The questionnaire is on the one part based on the Information Success Model by DeLone and McLean (D&M) and for the other part of the questionnaire based on the Technology Acceptance Model (TAM)[3-5]. Both models are one of the most widely used models of information systems success.

The D&M model includes six dimensions: information quality, system quality, service quality, intention to use, user satisfaction and net benefits. The TAM is based on the perceived ease of use and perceived usefulness to predict the attitude towards using the technology, subsequent behavioural intentions and actual usage.

Two different questionnaires have been designed for the pilot phase: one with 60 statements for the ML students and one with 32 statements for the ML lecturers, both versions were to be rated on a 5-point Likert scale. Furthermore, 34 learners' diaries were collected for intermittent review and 6 semi-structured interviews with purposively selected ML students have been conducted a female and male point of view of the

following three age groups: up to 35 years of age, 35 to 45 years of age, and older than 45 years of age.

III. Results: Evluation of Pilot Phase ML E-Learning PLatform

In the following we present the main findings of the pilot phase (see also Barteit and Neuhann [6]).

A. Cohort

The ML student cohort (n = 52) has a mean age of 39 years (range: 27-54years), and a mean of 13years of uninterrupted medical practise. The relative high age and the long duration of experience are explained by the fact that the programme was targeting Clinical Officers for an upgrade training (see table 2 and table 3). ML Lecturers have an average age of 45 years (range: 36 - 56 years), and a mean years of uninterrupted medical practise of 16,3 years, whereby most of the ML lecturers have more than 10 years of uninterrupted medical practise, 87,5% (14).

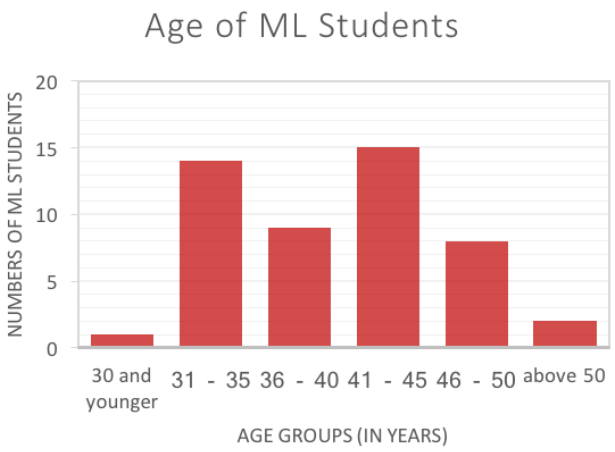

Fig. 1: Age distribution of ML Students in the year of the pilot study

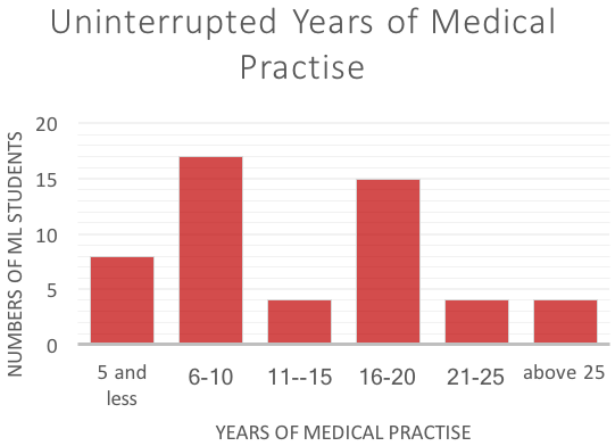

Fig. 2: Uninterrupted Years of Medical Practise ML Students

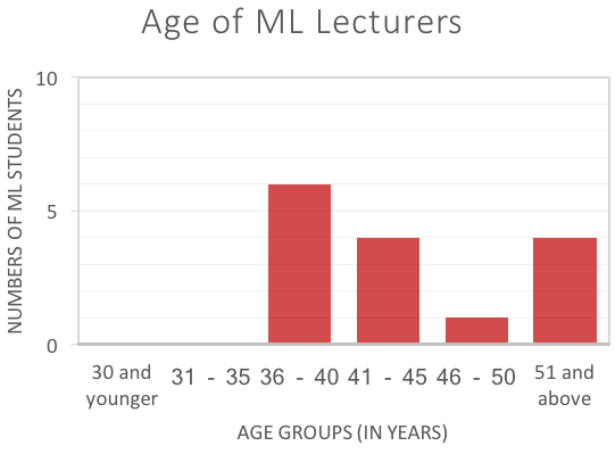

Fig. 3: Age distribution of ML lecturers and site consultants in the year of the pilot study

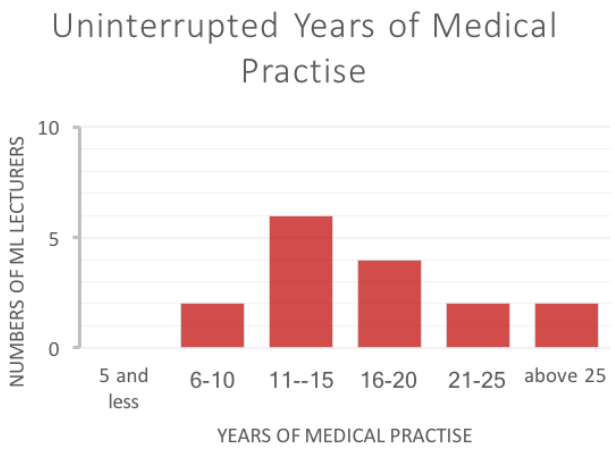

Fig. 4: Uninterrupted Years of Medical Practise ML Lecturers and site consultants

B. ML E-Learning Contents

The range of learning materials available to students covers static materials and interactive learning materials to train clinical decision-making (see *table 1*). Currently, there are eight Virtual Patients available for students on the e-learning platform: “An offensive smell”, “Virtual Patient Cases: HIV”, “Londiwe: A child with cough and fever”, “Abdominal Condition”, “An elderly woman who fell down”, “A mother with a sick infant”, “A semi-conscious patient”, and “An elderly lady with palpitations”. Virtual Patients are anonymous case presentations based on real cases. They are prepared as teaching material in form of interactive quizzes mainly employing multiple-choice and true/false-questions to work through a patient case. One Virtual Patient takes about 20 minutes to work through and aims to strengthen clinical decision-making.

A preliminary evaluation of the pilot phase shows the high relevance for learning and training. Students reported that they feel much better prepared for exams, that they have a positive attitude towards e-learning and that the tablet based learning fits the learning style, since it is a fast way for ML students to access materials and information. Also, lecturers generally have seen as very positive, and as a very useful addition to the

traditional teaching methods of the CCHS ML programme.

C. *Usage: ML E-Learning Platform*

Students reported that the tablet is very handy, not only with regards to its mobility, but regarding its size when accessing learning materials. Many ML students stated that operating the tablet and interacting with the tablet is fairly easy. Overall, lecturers showed acceptance towards technology and classified themselves to be able to work with computers as a tool for teaching, as well as employing the ML e-learning platform. However, some lecturers have indicated that they could benefit from an orientation into e-learning and possibly also into computers as a tool for teaching. Lecturers were also positive about the permanent establishment of part of the ML programme.

D. *Difficulties*

The deployment of a tablet takes 20 minutes per tablet on average and constitutes a major time involvement, keeping in mind that a total of 80 to 100 tablets have to be prepared. This sums up to a total time for deployment of around 24 deployment hours.

IV. Discussion and Conclusion

The aim of the introduced e-learning platform is to strengthen and supplement the teaching and training of the ML program. SolidarMed in collaboration with the BLiZ project has introduced an e-learning platform with an offline mobile component by providing tablets to ML students, free of charge during their studies. A first feedback of the students confirms the relevance to the ML program. Further details will be available after the first full evaluation, which is to be concluded in autumn 2017. The implementation brought with it some issues that have not been foreseen and produced some financial burdens. For example, tablets broke down due to technical issues but also due to wrong handling, so more than expected IT support at the practicum sites was necessary and produced additional travel costs. The training of lecturers, site consultants and students required substantial investment, and has to become more structured in future, as “computer literacy” was overestimated in the beginning.

IT staff support is a crucial aspect in providing und continuously running an e-learning platform. The IT support should be able to cover support for the server, tablets, and the e-learning platform contents management. In addition, it should include training in using the online and offline e-learning platform. The age of the ML students is quite heterogeneous and partly due to that, some students have had little exposure to IT equipment and thus, the level of proficiency varies substantially. Skilled IT staff has to account for these differences, as peer support proofed not to be sufficient.

Currently, we are looking into options in optimizing the deployment process for tablets. IT support is a vital part of enabling e-learning, as technical issues and need for IT support keep arising and must be taken care of so that ML students are able to make full use of the e-learning platform.

As stated before, this is reporting on on-going work. The second and more detailed evaluation of the e-learning platform will look into competence gain, technology acceptance, sustainability, relevance of e-learning contents for medical education and for daily clinical work, user-friendliness and its usage statistics. From September 2017, the third round of students will be enrolled to use the ML e-learning platform, which will be further improved based on the evaluation.

The pilot study and current results of the on-going evaluation, showed that the e-learning platform provides an excellent opportunity supporting self-directed learning and revision for ML students during their attachment to peripheral hospitals, where there are very limited on-site learning materials available and can serve a easily accessible point of reference for management of patients. With its focus on the knowledge needed by ML to

perform their clinical work and with providing easy access to existing treatment guidelines, it is envisioned that the platform is expanded in future to serve also as continuous professional education for the ML working in peripheral hospitals in Zambia.

Acknowledgment

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References

[1] Graf, U., et al., Strengthening Zambia's health workforce: the Medical Licentiate training programme, in Geneva Health Forum. 2013: Geneva.

[2] Barteit, S., et al., Self-directed e-learning at a tertiary hospital in Malawi–A qualitative Evaluation and Lessons learnt. GMS Zeitschrift für Medizinische Ausbildung, 2015. 32(1).

[3] Lin, H.-F., Measuring Online Learning Systems Success: Applying the Updated DeLone and McLean Model. CyberPsychology & Behavior, 2007. 10(6): p. 817-820.

[4] Mtebe, J.S. and R. Raisamo, A Model for Assessing Learning Management System Success in Higher Education in Sub-Saharan Countries. The Electronic Journal of Information Systems in Developing Countries, 2014. 61.

[5] Frehywot, S., et al., E-learning in medical education in resource constrained low- and middle-income countries. Human resources for health, 2013. 11(1): p. 4.

[6] Barteit, S. and F. Neuhann. Evaluation of tablet-based medical e-learning as part of a sustainable blended- learning approach for medical licentiates improving the quality of medical education and healthcare in rural Zambia. in Jahrestagung der Deutschen Gesellschaft für Tropenmedizin und Internationale Gesundheit eV. 2016. Bonn: DTG.

TABLE I. OVERVIEW MATERIALS ON THE ML E-LEARNING PLATFORM

	Internal Medicine	Surgery	Obstetrics and Gynecology	Pediatrics	Total
Lecture Notes	38	64	43	31	176
Medical Books	6	1	1	7	15
Exam Preparation	1	-	-	1	2
Treatment Guidelines	69	0	1	32	102
Videos	2	44	42	-	88
Pictures	-	-	-	39	39
Virtual Patients	4	1	-	2	7